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**FOURTH INTERIM REPORT
OF THE
FCC ADVISORY COMMITTEE ON
ADVANCED TELEVISION SERVICE**

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Chairman

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I. INTRODUCTION

This is the Fourth Interim Report of the Advisory Committee on Advanced Television Service.¹ The Advisory Committee was established by the Federal Communications Commission in 1987 to develop information that would assist the agency in establishing an advanced television ("ATV") transmission standard. The work of the Advisory Committee is being conducted primarily through its three Subcommittees (Planning, Systems and Implementation) and their constituent Working Parties and Advisory Groups.²

Earlier work of the Advisory Committee has been described in previous interim reports. During the period since the Third Interim Report was adopted, the bulk of the Advisory Committee's work has been devoted to making final preparations for the laboratory tests of ATV systems and formulating plans for field tests.³

¹ In addition to three previous interim reports (dated June 16, 1988, April 26, 1989 and March 21, 1990), the Advisory Committee, pursuant to a request from Congressman Edward Markey, Chairman of the Telecommunications and Finance Subcommittee of the House Energy and Commerce Committee, prepared a report (dated February 4, 1989) addressing the matter of the interrelationship between advanced television and U.S. "competitiveness."

² A roster containing the names and affiliations of the current members of the Advisory Committee and its Steering Committee (composed of the Advisory Committee Chair and the Chairman and Vice Chairs of the three Subcommittees) is attached as Appendix A.

³ In the period since the Third Interim Report, the FCC has also released a First Report and Order (First Report and Order in MM Docket No. 87-268, 5 FCC Rcd 5627 (September 21, 1990)) concerning advanced television systems. In this document, the Commission articulated the policies Chairman Sikes announced at the March 21, 1990 Advisory Committee meeting: that "augmentation" ATV systems would no longer be considered by the Commission and that adoption of an enhanced
(continued...)

As has been the case in the past, matters have arisen in the course of Subcommittee and Working Party activities that should be brought to the parent Advisory Committee for guidance and direction. In this Fourth Interim Report to the FCC, findings and conclusions are presented on several such unresolved matters and direction is provided concerning the tasks assigned to the Subcommittees that will guide their efforts over the remainder of the Advisory Committee's life.

The report is organized as follows. Section II presents descriptions of ATV proponent developments. Section III sets forth a brief progress report on the work of the Advisory Committee and its various constituent elements. Section IV discusses the preparations being made by the various testing laboratories. In Section V, the Advisory Committee's findings and conclusions are described, and concluding observations are provided in Section VI.

II. PROPONENT DEVELOPMENTS

Over the past twelve months, the identity of the ATV proponents and their system designs have changed considerably. At the time that the Third Interim Report was adopted, seven proponents had been assigned a total of nine test slots.⁴ Since then, Faroudja Laboratories and

³(...continued)
system standard would not be considered, if at all, until the agency reaches a final decision on an HDTV standard.

⁴ The nine ATV systems under consideration at that time were: Super NTSC (Faroudja), MUSE 6 and Narrow MUSE
(continued...)

Production Services have withdrawn their systems from consideration, and a new proponent -- General Instrument -- entered its new ATV system (DigiCipher).

In addition, three of the previously proposed systems have been withdrawn and replaced by new, all digital, designs. To assist the Advisory Committee in accommodating these developments, Chairman Wiley wrote the proponents in November 1990 and instructed those planning a design change to declare such intentions formally by the year's end. The letter also required that full technical information, leading to preliminary certification of these systems,⁵ be submitted to Committee by February 28, 1991.

Zenith subsequently announced both its partnership with AT&T and an intention to submit a totally digital ATV transmission system. Likewise, the Advanced Television Research Consortium (ATRC)⁶ indicated its plans to submit a

⁴(...continued)
(NHK), Genesys HDTV (Production Services, Inc.), ACTV-I and ACTV-II (David Sarnoff Research Center), Channel Compatible HDTV (MIT), Spectrum Compatible HDTV (Zenith), and HDS/NA.6 (Philips).

⁵ To facilitate planning by the Advisory Committee and the test facilities, proponent systems are required to be certified through SS/WP-1 in a two-stage procedure well in advance of the scheduled test date. A preliminary certification ("pre-certification") will be issued if, following a precursory review, it is determined that the system is technically feasible and the proponent will actually develop hardware for testing. A second, more rigorous, review (i.e., final certification) will be completed by SS/WP-1 sixty days before the date that a particular system is scheduled to move into the test center.

⁶ The ATRC is comprised of the David Sarnoff Research Center, NBC, North American Philips, and Thomson Consumer Electronics.

digital transmission system in lieu of the analog transmission system proposed initially. Subsequently, MIT and General Instrument announced the formation of the American Television Alliance (ATVA) that jointly would develop two digital simulcast HDTV systems.

As a result of these changes in proponents and system design, six systems from four proponents are currently scheduled for testing: ACTV (ATRC); Narrow MUSE (NHK); DigiCipher (ATVA); Digital, Spectrum Compatible HDTV (Zenith/AT&T); Advanced Digital Television (ATRC); and ATVA Progressive System (ATVA). One of these (ACTV) is an enhanced system, one (Narrow MUSE) is an analog simulcast transmission scheme, and the latter four are digital simulcast systems.

III. SYNOPSIS OF ADVISORY COMMITTEE ACTIVITIES

A. Planning Subcommittee

The Planning Subcommittee has been comprised of seven Working Parties and two Advisory Groups.⁷ During the past year, Working Party 1 (PS/WP-1; Technology Attributes and Assessment) and Working Party 2 (PS/WP-2; Testing and Evaluation Specifications) met jointly to amend the ATV attributes list. These Working Parties functioned in

⁷ The Advisory Groups, PS/AG-1 (Creative Issues) and PS/AG-2 (Consumer and Trade Issues), were idle for much of this period. PS/AG-1 (Creative Issues) has met recently and will remain active in the coming year.

coordination with Working Party 2 of the Systems Subcommittee (SS/WP-2; System Evaluation and Testing).

Working Party 3 of the Planning Subcommittee (PS/WP-3; Spectrum Utilization and Alternatives) began an intensive examination of issues related to the distribution of advanced television signals. PS/WP-3 also continued its efforts to analyze the broadcast spectrum requirements of ATV systems, undertaking studies of ATV accommodation statistics under various conditions. In addition, the Working Party began to formulate an approach for evaluating and comparing the laboratory data of particular ATV systems. The analytical tools needed in this regard are already being developed. In response to a request from Working Party 4 of the Systems Subcommittee (SS/WP-4; System Standard), PS/WP-3 also prepared a statement on how spectrum-related aspects of a particular system would be judged.

Working Party 4 of the Planning Subcommittee (PS/WP-4; Alternative Media Technology and Broadcast Interface) monitored the activities of other organizations, and identified issues related to subscriber access for study by these groups. Working Party 5 (PS/WP-5; Economic Factors and Market Penetration) interacted with Systems Subcommittee Working Party 3 (SS/WP-3; Economic Assessment) in order to further model ATV receiver penetration. These Working Parties also worked to model the costs which local stations may incur when implementing an ATV transmission system.

Working Party 6 (PS/WP-6; Subjective Assessment) was fully occupied with the many tasks associated with creating the ATV source material. Despite the complexities inherent in producing more than a dozen live-video scenes "identical" in each of five video formats (NTSC and four ATV), and many logistical obstacles, the project has been completed successfully.⁸

Finally, Working Party 7 (PS/WP-7; Audience Research) abandoned a study to test audience reaction to "letter-box" display of ATV programs on NTSC receivers because none of the remaining proponents intends to rely on this technique. Working Party 7 had previously developed a research plan to evaluate audience response to ATV service, but was unable to secure sufficient support to carry out the research plan. Consequently, the Working Party has been disbanded.

B. Systems Subcommittee

The Systems Subcommittee is composed of four Working Parties. Working Party 1 (SS/WP-1; Systems Analysis) and Working Party 2 (SS/WP-2; System Evaluation and Testing) continued to prepare for the testing of proponent systems. SS/WP-1 concluded its preparatory analysis of all ATV systems by pre-certifying seven transmission systems. Of these, one -- ACTV -- has been granted final certification by the

⁸ Remaining work on film and computer-generated video sequences is also underway.

Working Party. The remaining systems are scheduled to undergo final certification in the coming months.

As discussed in the previous section, the ATV proponents and their systems have changed over the past several months. Consequently, SS/WP-1 has recently acted to pre-certify the three newly designed, all-digital systems.

SS/WP-2 continued its efforts to finalize the Test Management Plan and the several Test Procedures Plans. Modifications and updates were made to the Test Management Plan, and two additional Test Procedures Plans, entitled "Audio Subjective Tests" and "Field Test Procedures," were approved.

In light of the very recent proponent system changes, however, further modifications have been required in the Test Procedures. These modifications have had an impact on the planned operations of the testing laboratories and on the test schedule (see Section IV below).

Since the Third Interim Report, SS/WP-3 (Economic Assessment) has addressed, jointly with PS/WP-5, transition scenarios for broadcasters. CBS and PBS each presented transition/cost studies to this Working Party which demonstrate how networks and affiliate stations might implement an ATV service and how it might co-exist with incumbent NTSC equipment. SS/WP-3 also attempted to define an ATV receiver penetration model.

Working Party 4 (SS/WP-4; System Standards) has formed a task force to determine what data will be needed to make a

standards recommendation, including the source and format of this information and the means by which the data should be reduced. In addition, SS/WP-4 has defined a process for recommending an ATV standard. In brief, this process will entail determination of whether proponent systems meet certain "critical objectives" for an ATV service. Systems which exceed these threshold objectives will be compared against each other in order to determine which could offer superior service.

C. Implementation Subcommittee

The Implementation Subcommittee is comprised of two Working Parties: IS/WP-1 (Policy and Regulation) and IS/WP-2 (Transition Scenarios). Since the Third Interim Report, the work of IS/WP-1 has been focused on two issues: alternative methods for assigning supplemental spectrum for ATV and the implications of the Ashbacker doctrine.⁹ IS/WP-1 prepared a report on the first issue that discusses the pros and cons of comparative processes, lotteries, auctions, and assigning capacity to all licensees uniformly. An analysis of the second issue continues.

Specialist groups of IS/WP-2 have developed PERT charts to model the implementation of ATV in several industry

⁹ Ashbacker Radio Corp. v. FCC, 326 U.S. 327 (1945). The granting of an application for a broadcast license that is mutually exclusive with another application, without considering the merits of that other application at the same time, deprives it of the opportunity for an administrative hearing as guaranteed by Section 309 of the Communications Act.

segments¹⁰ and to provide timelines that will define the course of the implementation scenarios prepared by the Working Party. Over the past year, IS/WP-2 has concentrated on identifying obstacles to ATV implementation. Probably the most significant issue presented is the adequacy of resources available to television stations and other ATV participants for conversion of facilities. Two limitations, personnel and capital, will be investigated in surveys of local area groups. These groups, comprised of the chief engineers from all of the television stations in a designated area, have been established by IS/WP-2 in New York, Los Angeles, Chicago, San Francisco, and Boston.

IV. TEST LAB ACTIVITIES

A. Facility Preparations

During the last year, construction of the Advanced Television Test Center (ATTC) laboratory has been completed at its Alexandria, Virginia facility.¹¹ While all but one element of the required equipment has been received, installed or scheduled for timely completion, the late

¹⁰ These segments include terrestrial broadcasting, production facilities, networks, cable, consumer electronics, common carriers, and satellite distribution.

¹¹ The Advanced Television Test Center was established by the broadcast industry, with support from the consumer electronics industry, as a forum for conducting the objective ATV transmission systems tests called for by the Advisory Committee.

arrival of this key element -- the format converter -- will contribute to a delay in the start of testing.¹²

The cable portion of the ATV test facility is now completed. The Cable Television Laboratories (CableLabs) test bed is located at ATTC in Alexandria, Virginia, and it has been constructed, tested, and accepted for performance of the tests described in the Cable Television Test Plan.¹³

Likewise, construction is virtually completed at the Advanced Television Evaluation Laboratory (ATEL), where the subjective evaluations of ATV system performance will be conducted.¹⁴ Although ATEL is also awaiting delivery of a format converter, trial runs are now underway and the lab will be ready to begin actual tests as required by the revised test schedule (see Section V below).

B. FCC Memorandum of Understanding

Since the time that it established the Advisory Committee and initiated its advanced television proceeding, the Federal Communications Commission has been actively involved with the private sector in shaping and guiding efforts to develop a terrestrial ATV standard. In November

¹² The manner in which the Advisory Committee is addressing this delay is discussed in Section V.

¹³ The Cable Television Laboratories (CableLabs) is the research and development entity of the cable television industry. It has several missions, including the conduct of cable television related tests on advanced television transmission systems.

¹⁴ ATEL was founded by a consortium of Canadian government and industry interests.

1990, the agency called upon the Committee, the ATTC and CableLabs to enter into a Memorandum of Understanding ("MOU") with the FCC that would formalize this government/industry partnership.

The general objectives of the MOU (attached as Appendix B) are to describe formally the role of the FCC, the Advisory Committee and the test labs and to provide a framework within which all parties can endeavor to accomplish the ambitious goals articulated by the Commission. Under the MOU, the FCC will have observers on site at the labs throughout the testing process. Commission staff will also participate as "expert viewers" for some of the objective tests. Finally, the agency will contribute, as feasible, staff and facilities for field testing.

The MOU charges the Advisory Committee, in conjunction with the proponents and the testing laboratories, "to seek to carry out the established procedures within the established deadlines."¹⁵ The Advisory Committee is also required to monitor the state of HDTV development to ensure that any important new technologies are not overlooked during the testing process.

For their part, the test labs have agreed to make all reasonable efforts to carry out their activities consistent with the Advisory Committee's plans and procedures and to provide the FCC with prompt reports of the test results. ATTC and CableLabs will also "seek to ensure that testing

¹⁵ MOU at p.3.

begins in a timely manner and is completed so as to permit the Advisory Committee to deliver its final report to the FCC on time."¹⁶

V. FINDINGS AND CONCLUSIONS

A number of matters have arisen in the work of the Subcommittees and their constituent Working Parties upon which judgments must be rendered by the Advisory Committee. Among the most pressing are matters concerned with changes in the test procedures, revision of the testing schedule, and securing the resources needed to conduct testing. The Committee's guidance has also been sought concerning future efforts that should be undertaken by the Subcommittees, and questions have arisen with regard to the comparative analysis that will be conducted among the ATV systems. The findings and conclusions of the Advisory Committee on these matters are presented below.

A. Test Issues

1. Digital Tests

The test procedures approved by the Advisory Committee previously contemplated ATV transmission systems that were predominantly analog in character. However, it is now evident that most of the systems being considered are totally digital. Accordingly, changes in the test procedures are

¹⁶ MOU at p.4.

needed to adequately characterize the performance of these systems.

This important and highly complex effort is being conducted by SS/WP-2, under the leadership of SS/WP-2 Chairman Mark Richer of PBS. Because it is essential that the testing process continue on schedule to the extent feasible, it is envisioned that these, and other, changes will be implemented using procedures established in the Committee's Third Interim Report.¹⁷

2. Test Schedule

In November, a final testing schedule was released by the Advisory Committee, CableLabs, ATEL and the Test Center. However, several circumstances have combined to require some change in the schedule. First, as mentioned above, the delivery of the format converter has been delayed well beyond the dates anticipated by the Advisory Committee. This delay has resulted in a postponement by ATTC of a number of tasks - including some form of plant validation -- that were to be conducted prior to the start of testing.

In addition, implementing at least some of the new digital test procedures will require a substantial amount of

¹⁷ Under these procedures, test changes are generally approved after they complete the normal Working Party/Subcommittee process. Any disputes are addressed by the Advisory Committee Chairman initially, with the final review residing in the full Advisory Committee.

software development¹⁸ to amend the established operating plan at ATTC, an effort that can be conducted only when an ATV system is not undergoing tests. Therefore, the lab cannot continue trial runs and complete its operational proofing for several weeks while the test equipment control program is being modified and de-bugged.

To accommodate these unexpected and unavoidable problems, some change in the test schedule is necessary. Testing will now commence in mid-May with an NTSC "dry-run", designed to validate the Test Center plant. Actual proponent system testing will begin during the second week of July.

These changes, however, are expected to have only a minimal effect on the overall Advisory Committee timetable. Among its many activities, SS/WP-2 has also further streamlined the existing test procedures and reduced the amount of time required for each system's test program. It currently is contemplated that objective and subjective testing of all six systems can still be completed very close to the Committee's existing schedule.

3. Resource Requirements for Field Tests and Other Activities

Despite the new challenges and technical difficulties that have been encountered in commencing laboratory testing, the Advisory Committee remains committed to maintaining the

¹⁸ SS/WP-2 is now considering ways to avoid any further impact on the testing labs and to contain the scope of other tests.

FCC's deadline for completion of its mandate. Field tests of a preferred ATV system are viewed as important by many segments of the industry and, within the Advisory Committee's schedule, some form of such a test program is deemed both possible and necessary. Inevitably, of course, the new ATV standard will undergo extensive evaluation by the industry itself.

In preparation for the Advisory Committee tests, SS/WP-2 has made remarkable progress in developing a concise set of field test procedures and identifying sources of support for this effort. At this juncture, several transmission equipment manufacturers have offered to assist the Advisory Committee by supplying equipment and manpower. In addition, CableLabs has announced its intention to engage in cable system field tests under the Advisory Committee's auspices.

However, Chairman Richer of SS/WP-2 tentatively has estimated that \$1 million in manpower and equipment may still be required to perform these tests. The Advisory Committee Chairman has solicited the assistance of the ATV proponents in obtaining the needed resources and, by May 6, the proponents are to submit their ideas in this regard. The possible participation of ATTC in the implementation of the field tests is also being explored.

Another potentially significant resource requirement is the need to underwrite skilled private sector personnel to

participate in the expert viewer panels.¹⁹ Hopefully, as has been true in the work of the Advisory Committee generally, the companies with whom these experts are affiliated -- including those represented on the Advisory Committee -- will donate the time and money required to support their participating employees.

B. Decision Process Issues

The preferred ATV transmission system is one that offers the "best" mix of inherent performance quality, spectrum characteristics (including coverage and interference performance) and cost effectiveness. A tension exists among these qualities, however, and improving performance in one area can sometimes only be achieved by sacrificing performance in another. Accordingly, the development of an optimal technical description will require an analysis of the relative importance to broadcasters and viewers of these three qualities. With the commencement of laboratory tests in the immediate offing, this is an appropriate time for the Advisory Committee to begin consideration of those

¹⁹ Based on recommendations in the Planning Subcommittee's Third Interim Report, the test plan now calls for employing panels of expert viewers to establish thresholds and ranges of the various subjective impairments. Use of this approach ensures that, without sacrificing the quality of test results, the time and money expended on subjective testing can be reduced substantially from what otherwise would be required.

characteristics which such a system should possess and also the means it will employ to recommend an ATV system.²⁰

1. Coverage Area and Spectrum Issues

A few important steps have already been taken.²¹ PS/WP-3, for example, has articulated what it considers to be desired properties of a preferred system. These properties include performance attributes sufficient to provide essentially all existing broadcasters with a simulcast channel whose coverage characteristics are equivalent to NTSC service.

Studies of the methodology of making simulcast channel assignments are underway outside the Advisory Committee process. A widespread industry agreement as to the process is believed to be achievable. Once agreement is reached, the result will be submitted to the Advisory Committee for its analysis. The Advisory Committee intends to fashion specific recommendations in this area so that the FCC can be in a position to make spectrum decisions at the same time that it concludes its consideration of an ATV standard.

²⁰ Regardless of the criteria used, the Committee intends to base its evaluation of ATV systems on empirical data, derived from the testing process, and other information (regarding spectrum requirements and cost) produced in studies conducted under the auspices of its various working parties.

²¹ Importantly, SS/WP-4 has developed an iterative framework for comparing the performance of ATV systems which relies on comparing only those systems which meet certain "critical objectives."

2. Digital Systems "Threshold Effect"

It has been suggested that the digital transmission systems may exhibit a sharp drop-off in quality as received signal strength falls below some minimum threshold. If such an effect occurs, one consequence of selecting a digital ATV system could be a far more sharply defined coverage area than is currently the case with NTSC systems (which degrade gracefully in proportion to received signal strength).

The Advisory Committee recognizes that, because of this possible characteristic of digital systems, ATV broadcasting might differ in some respects from NTSC broadcasting. Nevertheless, at this juncture, the Advisory Committee foresees several factors which possibly could compensate for this so-called "threshold effect" of digital systems.

One important mitigating factor could be the establishment of ATV coverage areas equivalent to existing NTSC contours. This characteristic already has been identified above as a desired property of a preferred ATV transmission system, and proponents are working hard to bring it to realization. In addition, there may be technical methods of reducing the threshold effect. The Advisory Committee intends to study this issue over the course of the next several months.

3. Combinations of System Characteristics

Ultimately, it is the Advisory Committee's goal to agree on an ATV technical description that can be recommended to

the FCC for consideration as the next generation television transmission standard. It is anticipated that the Committee will find that one of the ATV proponent systems best fulfills this description. However, in the unlikely event that each system proves to be inadequate, a new design could be composed of elements drawn from the different systems. If so, the Advisory Committee would encourage the establishment of voluntary agreements among proponents to synthesize their designs.

C. Technology Review

Among the responsibilities assumed by the Advisory Committee under the MOU is the development of a plan for reviewing the state of technology prior to the conclusion of testing. The goal of this activity is to identify whether there exist any "new technical advancements in the state of the art, not already provided by the ATV systems pre-certified by the Advisory Committee, that appear to offer important benefits to the public and are sufficiently concrete so as to be tested contemporaneously with the pre-certified systems."²²

Given the Advisory Committee's limited resources and stringent timetable, the standard for accommodating a new ATV concept necessarily must be a rigorous one. Thus, while important technological advancements will be accorded consideration, the Committee does not intend to impair its

²² MOU at p.4.

entire process absent a demonstrable and compelling public interest benefit.

The Systems Subcommittee will be assigned initial responsibility to conduct the technology review, in consultation with the Planning Subcommittee and the Advisory Committee Chairman. Preparations for this activity should begin at a sufficiently early point in time to permit its completion within the first quarter of 1992.

VI. CONCLUDING OBSERVATIONS

The development of an advanced television transmission standard is uncharted water, and the difficulty of conducting a task that has never before been performed cannot be understated. However, the proponents and industry participants alike are exhibiting a high degree of creativity and innovation. In particular, the dramatic change in the nature of many of the systems may have advanced the entire ATV program in this country in ways that could not have been foreseen a year ago.

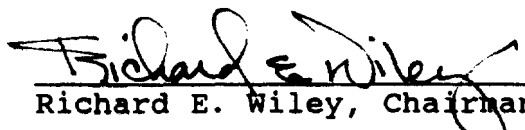
However, these pioneering efforts have placed a substantial strain on the Advisory Committee and the test laboratories. Already burdened by unforeseen delays in equipment delivery, the Committee and labs must now deal with the necessity to fashion altered test procedures, especially to accommodate digital ATV systems. Nevertheless, as indicated, the parties remain committed to completing their work within the time schedule established by the FCC.

The Advisory Committee is indebted to the hundreds of firms and individuals involved in this entire project. Their cooperative and productive efforts already have made a great contribution to the advancement of the video medium in this country. The Committee also is extremely grateful for the continuous oversight, guidance and support provided by the FCC (especially by its Chairman and key staff officials). We welcome a continued active role by the Commission staff in all of the Committee's undertakings, especially the critical testing of ATV proponent systems.

Respectfully submitted,

FCC ADVISORY COMMITTEE ON
ADVANCED TELEVISION SERVICE

By:


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